

(12) **UK Patent Application** (19) **GB** (11) **2 204 321** (13) **A**  
(43) Application published 9 Nov 1988

<p>(21) Application No 8810508</p> <p>(22) Date of filing 4 May 1988</p> <p>(30) Priority data (31) 3715065 (32) 6 May 1987 (33) DE</p>	<p>(51) INT CL<sup>4</sup> C11D 1/68 1/72 1/722 3/30 3/33</p> <p>(52) Domestic classification (Edition J): C5D 6B11A 6B12B1 6B12B2 6B12E 6B12G2A 6B12G2B 6B12G2C 6B12M 6B12N1 6B1 6B2 6C8</p> <p>(56) Documents cited GB 1484844</p> <p>(58) Field of search C5D Selected US specifications from IPC sub-class C11D</p>
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(54) **Biodegradable liquid detergent**

(57) Biodegradable liquid detergent compositions contain a fatty alcohol polyethylene glycol ether, an alkanolamine, a sequestering agent and a fatty alcohol polyethylene/polypropylene glycol ether.

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# IMPROVEMENTS IN OR RELATING TO ORGANIC COMPOUNDS

This invention relates to detergent compositions.

Detergent compositions comprising mixtures of non-ionic surfactants, alkanolamines and complexing agents (sequestering agents) are known, and often contain polyalkylene oxides as the non-ionic surfactant. These give excellent cleaning properties without excessive foaming, but have the disadvantage of low biodegradability.

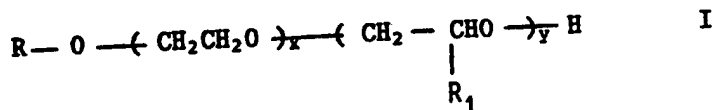
The present invention provides a biodegradable detergent comprising an aqueous solution containing

(A) 2 - 35% by weight of a C<sub>8-22</sub> fatty alcohol polyethylene glycol ether having 5-25 alkylene oxide residues

(B) 5 - 35% by weight of an alkanolamine

(C) 0.5 - 6% by weight of a sequestering agent

and (D) 0.5 - 5% by weight of a biodegradable, low-foaming non-ionic surfactant of formula I



in which R is C<sub>8-22</sub>alkyl,

$R_1$  is methyl or ethyl, preferably methyl  
 $x$  is a number from 1 to 12  
and  $y$  is a number from 1 to 5, such that the ratio  $x:y$   
is from 3:1 to 1:3.

The detergent composition according to the invention may further contain any one or more of the following components (E)-(J)

- (E) up to 5% of a  $C_{6-12}$  alkyl sulphosuccinate
- (F) up to 20% of a dodecylbenzene sulphonic acid, paraffin sulphonic acid or lauryl ether sulphate
- (G) up to 10% of a  $C_{2-4}$  alkyl ester of a sulphated, at least partially unsaturated  $C_{16-18}$  carboxylic acid
- (H) up to 10% of a higher ( $C_{8-14}$ ) alcohol or a mixture of such alcohols
- (I) up to 2% of a water soluble silicone oil
- (J) up to 5% of a hydrotrope

as well as minor amounts of the following components (K)-(N)

- (K) a lower ( $C_{1-4}$ ) alcohol or mixture of such alcohols
- (L) a  $C_{2-6}$  glycol
- (M) soap, particularly soft soap
- (N) a water-insoluble organic solvent

and up

to 25%

of (O) an additional dispersing agent.

All of the above percentages are by weight based on the entire composition including water. Preferably the total amount of active ingredients (A)-(N) lies between 15% and 30% by weight of the total composition.

Component (A) preferably consists of a mixture of glycol ethers, preferably glycol ethers of  $C_{8-18}$ , more preferably  $C_{12-16}$  fatty alcohols, having preferably on average 5-12 alkylene oxide residues, more preferably 6-10. The alkylene oxide is preferably ethylene oxide.

Compound (B) is preferably mono-, di- or triethanolamine, particularly the second and last of these, or mixtures thereof.

Sequestering agents (C) are preferably nitrilocarboxylic acids, particularly nitrilotriacetic acid; polycarboxylic acids, particularly citric acid; polyacrylic acids and their salts, particularly their sodium salts; and gluconates and heptonates, particularly the sodium salts. The quantity of component (C) to be used will depend upon the hardness and heavy metal ion content of the water.

Component (D) is preferably a lauryl polyglycol ether with on average 5 ethylene oxide and 4 propylene oxide residues.

The additional components (E) to (N) may together constitute up to 20% by weight of the composition (including water).

Component (E) is preferably the isooctyl (i.e. 2-ethylhexyl) ester of sulphosuccinic acid.

Component (F) is preferably dodecylbenzenesulphonic acid or lauryl ether sulphate. Component (G) is preferably a sulphated oleic acid ester. Component (H) is preferably a commercial grade of tetramethylnonanol and component (I) is any commercially available soluble silicone oil. Components (H) and (I) are preferably used when it is desired to reduce foam formation as much as possible. Compound (J) is preferably cumene sulphonate.

Component (N), if present, is preferably white spirit or a chlorinated hydrocarbon. If the presence of an additional detergent (O) is required (particularly for use in ultrasonic cleaning), the preferred substance is a salt, particularly the sodium salt, of dinaphthylmethanedisulphonic acid, which may be used in quantities of up to 25% by weight.

Calculated on the basis of the percent by weight of active ingredients (without water), the preferred quantities of components

A-J are as follows:

	preferred	more preferred
A	15 - 70 %	15 - 30 %
B	15 - 60 %	20 - 35 %
C	0.5- 30 %	3 - 25 %
D	0.1- 10 %	2 - 5 %
E	0 - 25 %	3 - 10 %
F	0 - 35 %	0 - 10 %
G	0 - 35 %	0 - 10 %
H	0 - 15 %	0 - 10 %
I	0 - 5 %	0 - 2 %
J	0 - 10 %	2 - 6 %.

The compositions according to the invention may be prepared by simple mixing, adding the components to demineralized water and stirring until the product is homogeneous. The pH value of the product is preferably 11-12.5, more preferably 11.5-12.5, and may be adjusted to this range by addition of alkali if required.

The detergent composition according to the invention is particularly useful for laundering of heavily-soiled textiles in industrial and hospital laundries, in ultrasonic cleaning processes, or generally for the cleaning of heavily-soiled objects or equipment.

The detergent composition according to the invention has a powerful cleaning action. It may be used for example for the cleaning and degreasing of metal, plastics, synthetic materials, glass and ceramics in all branches of industry, including the foodstuff, animal feed, pharmaceutical, automotive, photography and nuclear energy sectors, e.g. machinery, machine parts, kettles, tanks, autoclaves, moulds, instruments, tools, filter press components and filter cloths. It may be used to remove deposits of mineral oil, grease, graphite, blood, albumen, starch derivatives, dust, carbon, dyestuffs etc. It may also be employed for cleaning surfaces, e.g. table tops; floors and walls of hospitals, smoke chambers, slaughterhouses and butcher

shops; and roads and tunnels. When used for cleaning steel and chrome nickel steel, the detergent composition exhibits an additional, highly advantageous anticorrosive effect.

The detergent composition of the invention is also indicated as a detergent for the washing (pre-, main- and/or after-washing) of dyed or undyed natural and regenerated cellulose fibres, e.g. cotton, linen, viscose staple fibres, and polyester/cellulosic fibre blends; it may be used for domestic purposes or in industrial laundries for the cleaning of e.g. hospital and institutional linens, workwear, aprons and overalls. It can be used in the normal industrial laundry equipment e.g. discontinuous washing machines such as wash centrifuges and continuous machines such as washing tunnels.

The detergent composition of the invention may also be used for ultrasonic cleaning. Mechanical parts such as ball bearings, gear wheels, watches, valves, nozzles, jewellery, crystals, quartz, medical instruments, glass laboratory equipments and electronic circuits may be cleaned with the detergent composition in the presence of an ultrasonic generator. The detergent composition containing additionally a dispersing agent such as specified is particularly indicated for ultrasonic cleaning.

For cleaning contaminated objects in a wash bath, the aqueous detergent composition (15-30% of active components) is suitably used in a concentration of 1 to 10% by weight in water, according to the nature of the contamination to be removed. For cleaning by spraying or wiping on, the aqueous detergent composition is preferably used in a concentration of 5 to 30% by weight in water. As an additive in sand- or steam-blasting, the aqueous detergent composition may be used undiluted or in a concentration of 5 to 10% by weight in water. As a washing detergent, the composition is used in an amount depending on the nature and the degree of the contamination to be removed; preferably, the aqueous detergent composition is used in a concentration of 1 to 5% by weight (of the 15-30% active composition).

The following Examples, in which all parts and percentages are by weight, illustrate the invention. The temperatures are indicated in degrees Centigrade.

### Example 1

To 60 parts demineralized water in an open vessel at room temperature are added 4 parts of cumene sulphonate (as 40% aqueous solution) and 1 part of dodecylbenzene sulphonic acid, and the mixture is stirred until clear. The following components are then added in order, with continued stirring, waiting until one component is completely dissolved before adding the next:

- 12 parts triethanolamine
- 10 parts of a 40% aqueous solution of sodium nitrilotriacetate
- 12 parts of the reaction product of 7 moles of ethylene oxide with 1 mole of a mixture of C<sub>12-15</sub> alcohols (obtainable under the trademark Sandoxylate A 25-7 from Sandoz Ltd., Basle, Switzerland)
- 1 part lauryl alcohol polyglycol ether containing 5 ethylene oxide and 4 propylene oxide units per mole (obtainable from Sandoz Ltd. under the trademark Sandoxylate LFW).

After stirring for 10-60 minutes (according to the size of the batch) a composition is obtained containing:

Component A	12	% by weight
B	12	% by weight
C	4	% by weight
D	1	% by weight
F	1	% by weight
J	1.6	% by weight
water	68.4	% by weight,

which may be used as such in the following Examples 2 and 3.

### Example 2

Laboratory glassware which has been left to stand contaminated with dried blood, brain substance and albumin is immersed in a



solution containing from 3 to 5% by weight of the composition of Example 1, according to the degree of contamination. After immersion for 2-3 hours at 80° or 12 hours at room temperature the glassware is ready for re-use after rinsing with clean water.

### Example 3

Glassware, metal parts and plastic equipment contaminated with oil or grease may be cleaned by immersion in a solution containing 1-5% by weight of the composition of Example 1.

### Examples 4-8

Mixtures as shown in the following Table are prepared as described in Example 1.

		TABLE				
		<u>parts by weight (total 100.0)</u>				
<u>Component</u>	<u>Ex.</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
(A) Sandoxylate 25-7		9.0	10.0	11.0	12.0	14.0
(B) triethanolamine		12.0	12.0	-	-	-
(B) diethanolamine		-	-	12.0	12.0	10.0
(C) Na nitrilotriacetate (40% aqu.)		10.0	10.0	10.0	10.0	10.0
(C) citric acid		-	-	-	0.3	-
(D) Sandoxylate LFW		3.0	2.5	2.0	1.5	1.0
(F) dodecylbenzenesulphonic acid		1.0	0.5	1.0	-	1.5
(J) cumene sulphonate (40% aqu.)		2.0	3.0	3.0	3.0	5.0
demineralized water		63.0	62.0	61.0	61.2	58.5

### Example 9

Hospital laundry (white linen) is treated as follows in a continuous washing process (wash tunnel, 18 sections):

Sections 1-5: prewash at 20-50°. In section 1, addition of 6 l of a

s lution made by adding 12 parts f the composition of Example 6 to 1000 parts of water and 20 g f a dirt-releasing commercial pre-wash powder. In section 5, addition of a further 3 l of the diluted composition of Example 6.

Sections 6-10: wash at 80-95°

Sections 11-15: rinse at 80-60°

Section 16: hypochlorite bleach at 20-30° (the bleach contains 0.85 g NaClO / litre of soft water).

Section 17: peroxide treatment at 20° (0.1 g/l 25% H<sub>2</sub>O<sub>2</sub>) and neutralisation with acetic acid

Section 18: Clear rinse at 15-18°.

The resulting laundry is pure white and meets hospital standards.

#### **Example 10**

Strongly stained polyester/cotton overalls are washed as described in Example 9, with the following changes:

The detergent solution used contains 30 g/l of the composition of Example 4, and 40 g of the pre-wash powder are added. Washing is carried out at 80-85°, and a further 4 l of diluted detergent solution are added in section 10.

The clothing is clean and free from oil stains.

**Example 11**

42.5 parts of the composition of Example 4 are mixed with 2.5 parts of soft soap, 5 parts of hexylene glycol and 50 parts dinaphthylmethanedisulphonic acid Na salt (50% aqueous solution).

**Example 12**

Electronic microcircuits are cleaned by immersion in a 1 % solution of the product of Example 11 and ultrasonic treatment at 25 kHz for 90 seconds.

**Example 13**

Watch cases are completely cleaned from polishing paste by ultrasonic treatment in a 4 % solution of the product of Example 11.

**CLAIMS: -**

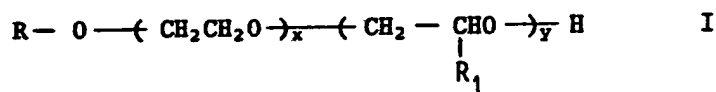
1. A biodegradable detergent comprising an aqueous solution containing

(A) 2 - 35% by weight of a C<sub>8-22</sub> fatty alcohol polyethylene glycol ether having 5-25 alkylene oxide residues

(B) 5 - 35% by weight of an alkanolamine

(C) 0.5 - 6% by weight of a sequestering agent

and (D) 0.5 - 5% by weight of a biodegradable, low-foaming non-ionic surfactant of formula I



in which R is C<sub>8-22</sub>alkyl,

R<sub>1</sub> is methyl or ethyl,

x is a number from 1 to 12

and y is a number from 1 to 5, such that the ratio x:y is from 3:1 to 1:3.

2. A detergent composition according to Claim 1 further containing any one or more of the following components (E)-(J)

(E) up to 5% of a C<sub>6-12</sub> alkyl sulphosuccinate

(F) up to 20% of a dodecylbenzene sulphonic acid, paraffin sulphonic acid or lauryl ether sulphate

(G) up to 10% of a C<sub>2-4</sub>alkyl ester of a sulphated, at least partially unsaturated C<sub>16-18</sub> carboxylic acid

(H) up to 10% of a higher (C<sub>8-14</sub>) alcohol or a mixture of such alcohols

(I) up to 2% of a water soluble silicone oil

(J) up to 5% of a hydrotrope

- (K) a lower ( $C_{1-4}$ ) alcohol or mixture of such alcohols
- (L) a  $C_{2-6}$  glycol
- (M) soap, particularly soft soap
- (N) a water-insoluble organic solvent

and up

to 25%

of (O) an additional dispersing agent.

3. A detergent composition according to Claim 1 or Claim 2 in which the total amount of active ingredients (A)-(N) lies between 15% and 30% by weight of the total composition.

4. A detergent composition according to any one of the preceding claims in which component (A) is a mixture of glycol ethers of  $C_{12-16}$  fatty alcohols having on average 6-10 ethylene oxide residues.

5. A detergent composition according to any one of the preceding claims in which component (C) is nitrilotriacetic acid.

6. A detergent composition according to any one of the preceding claims in which component (D) is a lauryl polyglycol ether having on average 5 ethylene oxide and 4 propylene oxide residues.

7. A detergent composition according to any one of the preceding claims in which component (F) is dodecylbenzene sulphononic acid.

8. A detergent composition according to any one of the preceding claims in which component (J) is cumene sulphonate.

9. A detergent composition according to any one of the preceding claims in which the quantities of components (A)-(J), percentages by weight of active ingredients, without water, are in the ranges:

A	15 - 70 %
B	15 - 60 %
C	0.5- 30 %
D	0.1- 10 %
E	0 - 25 %
F	0 - 35 %
G	0 - 35 %
H	0 - 15 %
I	0 - 5 %
J	0 - 10 %.

10. A detergent composition according to Claim 9 in which the quantities of components (A)-(J), as percentages by weight of active ingredients, without water, are in the ranges:

A	15 - 30 %
B	20 - 35 %
C	3 - 25 %
D	2 - 5 %
E	3 - 10 %
F	0 - 10 %
G	0 - 10 %
H	0 - 10 %
I	0 - 2 %
J	2 - 6 %.

11. A detergent composition as described in any one of Examples 1 and 4-8.

12. A process for industrial or domestic laundering, in which from 1 to 5 % by weight of a composition according to any one of claims 1-11 is added to the wash liquor.

13. A composition according to any one of Claims 1-11 containing in addition up to 25% of dinaphthylmethane disulphonic acid.

14. A process for ultrasonic cleaning of articles, comprising immersion of the articles in an aqueous bath containing a diluted composition according to Claim 13 and applying ultrasonic energy.